Filler-Induced Composition Waves in Phase Separating Polymer Blends (Invited)

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We investigate the influence of a dilute concentration of filler particles on blend phase separation using a generalization of the Cahn-Hilliard-Cook (CHC) model to include fillers (spheres, fibers, platelets) with a surface interaction. These simulations under a range of conditions are compared with experiments on phase separating blends with filler particles and other blend phase separation problems where heterogeneity influences the phase separation process. Simulation shows that the selective affinity of one of the polymers for the filler surface leads to the development of concentration waves about the filler particles at an early stage of phase separation in near critical composition blends. These "target" composition patterns are overtaken in late stage phase separation by a growing "background" spinodal pattern characteristic. In far-off critical composition blends, an "encapsulation layer" grows at the interface of the filler rather than a target pattern if the encapsulating polymer has a favorable interaction, while no enrichment occurs if the majority phase has the more favorable filler interaction. A linearized analysis of the CHC model is used to estimate the number of composition oscillations centered about the additive particles and the predictions of these calculations are compared to CHC simulations.